CLAIMS

What is claimed is:

1. A waste gas treatment system, comprising:

a thermal oxidizer, for oxidizing selected gaseous species of a waste gas stream at an elevated temperature;

a cyclone scrubber coupled to an outlet of the thermal oxidizer, for removing at least a portion of the particulate matter and acid gases of the waste gas stream, the cyclone scrubber including a tube through which the waste gas stream flows and means for fully wetting the inner surface of the tube;

a packed bed scrubber containing a packing material and coupled to an outlet of the cyclone scrubber, for removing remaining particulates and acid gases of the waste gas stream; and

a means for drawing the waste gas stream through and from the waste gas treatment system.

2. The waste gas treatment system of Claim 1, wherein the gas drawing means comprises a blower coupled to an outlet of the condenser.

3. The waste gas treatment system of Claim 1, further comprising a condenser coupled to an outlet of the packed bed scrubber, for reducing a water vapor concentration of the waste gas stream.

4. The waste gas treatment system of Claim 1, wherein the thermal oxidizer further comprises an oxidizing gas inlet for injecting a pressurized oxidizing gas stream into the waste gas stream for creating a turbulent mixture for greater combustion efficiency.

5. The waste gas treatment system of Claim 1, wherein the thermal oxidizer further comprises a tube through which the waste gas stream passes.

6. The waste gas treatment system of Claim 5, further comprising a means to heat the surface of the tube for oxidation of selected gaseous species of the waste gas stream.

7. The waste gas treatment system of Claim 1, wherein the inside of the thermal oxidizer is lined with Nickel.

8. The waste gas treatment system of Claim 1, wherein the packed column is a counter flow type packed column.

9. The waste gas treatment system of Claim 1, wherein the packed column packing material is comprised of alumina ceramic.

10. The waste gas treatment system of Claim 1, wherein the packed column packing material is comprised of stainless steel.

11. The waste gas treatment system of Claim 1, wherein the packed column packing material is comprised of Teflon.

12. The waste gas treatment system of Claim 1, wherein the packed column packing material is comprised of polypropylene.

13. The waste gas treatment system of Claim 1, wherein the water supplied to the cyclone scrubber is recycled wastewater from the packed column.

14. A method of abating toxic gases and particulate matter from a waste gas stream in a treatment system, comprising the steps of:

introducing the gas stream into the treatment system;

oxidizing selected gaseous species in the gas stream at an elevated temperature to reduce the presence of combustible substances in the gas;

scrubbing the gas stream to reduce the presence of particulate matter and acid gases in the gas;

filtering the gas stream through a packed column to reduce the presence of acid gas species in the gas; and

expelling the gas stream to ambient and drawing the gas stream through the treatment system.

15. The method of Claim 14, further comprising the step of condensing the gas stream to reduce the moisture content in the gas before the gas is expelled to ambient.

16. An apparatus for removing particulate matter and acid gases from a waste gas stream while inhibiting clogging and corrosion of a waste gas treatment system, the apparatus comprising:

a system inlet for the introduction of the waste gas stream;

a cooling section coupled to the system inlet, the cooling system including

a heat exchange means for cooling the waste gas and

a wetting means for reducing clogging and corrosion caused by particulate matter in the waste gas;

a scrubbing section coupled to the cooling section, for removing at least a portion of the particulate matter and acid gases of the waste gas stream; and

an outlet for discharging the treated waste gas.

17. The apparatus of Claim 16, wherein the wetting means of the cooling section comprises:

an outer tube and an inner tube, wherein

the inner tube has a diameter less than that of the outer tube, and

the inner tube is located inside of and substantially concentric with the outer tube, forming an annulus between the inside surface of the outer tube and the outside surface of the inner tube; and

one or more cyclonic water inlet jets extending into the annulus through the outer tube, providing a cyclonic flow of water in the annulus around the inner tube, wherein the cyclonic water flow fills the annulus and cascades over the top of the inner tube wetting the inside and outside surfaces of the inner tube and the inside surface of the outer tube, wherein the wet surfaces of the inner and outer tubes inhibit adherence of the particulate matter in the waste gas to the inside surfaces of the tubes.

18. The apparatus of Claim 16, wherein the heat exchange means of the cooling section comprises:

an outer tube and an inner tube, wherein

the inner tube has a diameter less than that of the outer tube, and

the inner tube is located inside of and substantially concentric with the outer tube, forming an annulus between the inside surface of the outer tube and the outside surface of the inner tube; and

one or more cyclonic water inlet jets extending into the annulus through the outer tube, providing a cyclonic flow of water in the annulus around the inner tube, wherein the cyclonic water flow fills the annulus and cascades over the top of the inner tube, wetting the inside and outside surfaces of the inner tube and the inside surface of the outer tube, wherein a heat exchange occurs between the waste gas stream and the water to reduce the temperature of the waste gas stream as it flows through the cooling section.

19. The apparatus of Claim 16, wherein the scrubbing section further comprises:

one or more water atomizers extending into the scrubbing section for

establishing forced contact between pressurized water droplets and particulate matter in the waste stream, causing the particulates to adhere to the water, forming a water/particulate mixture, and

causing absorption of at least a portion of the acid gases of the waste gas stream into the water; and

a means for expulsion of the water/particulate mixture from the scrubbing section.

20. The apparatus of Claim 19, wherein the water supplied to the water atomizers is fresh water.

21. The apparatus of Claim 19 wherein the water supplied to the water atomizers is recycled wastewater.

22. A method of inhibiting clogging and corrosion of components in a waste gas treatment system, comprising the steps of:

providing an inner tube through which a waste gas stream flows;

providing an outer tube, wherein

the outer tube has a diameter greater than that of the inner tube, and

the inner tube is located inside of and substantially concentric with the outer tube, forming an annulus between the inside surface of the outer tube and the outside surface of the inner tube;

injecting a cyclonic water flow into the annulus, causing a wetting of the inside surface of the outer tube and the outside surface of the inner tube; and

filling the annulus until the water level cascades over the top of the inner tube, forming a film of water on the inside surface of the inner tube, inhibiting the adhesion of particulate matter from the waste gas stream to the inside surface of the inner tube, preventing clogging and corrosion of the tube.